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# Mini-Tapping Sugar Maples for Sap-Sugar Testing

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## Abstract

Describes a technique using cannulas, surgical tubing, and small containers to obtain sap samples for use in determining the sugar content of sap in small sugar maple trees. This technique is used on trees directly exposed to the weather, and sets a minimum tappable tree diameter of 1.5 cm.

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The Northeastern Forest Experiment Station's on-going program for the genetic improvement of sugar maple (*Acer saccharum* Marsh.) for the sugar content of sap currently includes the progeny testing of trees selected for superior sap-sugar production. Among the problems that arose in carrying out this research was the inability to determine sap sweetness in large numbers of small seedlings.

The selection of superior genotypes at an early age requires a knowledge of the relationship between juvenile and mature performances of individual trees. Most attributes are easy to measure in the juvenile stage, but it is difficult to measure the sugar content of sap in large numbers of young sugar maples. The seedlings must be tapped to obtain sap samples for testing, but their small diameters and the few drops of sap available from each pose serious obstacles to juvenile evaluation. This paper describes a method developed for mini-tapping young trees.

Previous efforts by researchers to obtain sap from small trees have met with mixed success. But in all attempts, only a few trees were tested. Atkinson (O. R. Atkinson, Northeastern Forest Experiment Station, personal communication, Jan. 26, 1981) first experimented with the use of hypodermic needles as sap spiles. He found that some sap could be obtained from seedlings as small as 0.5 cm in diameter, but that the sap flow was more dependable from sapling-size trees. Kriebel (1963), working with potted seedlings ranging in diameter from 0.5 to 1 cm, was unsuccessful in developing techniques for early diagnosis of superior sap-sugar producing genotypes. Koelling (1968) used hypodermic needles in combination with a portable shelter to obtain sap from a small number of 3-year-old seedlings growing in a nursery. Under optimum conditions, the sap flow potential of seedlings of this size could not be sustained for more than 30 minutes.

We attempted the first, large-scale application of a mini-tapping technique in the nursery phase of a rangewide, progeny-provenance study of sugar maple (Gabriel 1969). Pairs of seedbeds were planted in an experimental design and covered with a portable, polyethylene quonset-type greenhouse to aid in raising the air temperature around the seed-

lings to sap-flow level (Fig. 1). A number 20 cannula was used as a spile. To reduce clogging with plant tissue, holes were drilled into stems with a battery-operated drill and a bit that matched the outside diameter of the cannula. When a drop of sap appeared at the end of the spile, it was tested for sugar content with a refractometer (Fig. 2).

With this technique we were able to obtain sap samples from only 23 percent of the seedlings during the sap-flow period. To prevent confounding of sap-sugar content and time of testing, all seedlings in at least one replicate must be tested during the same sap-flow period. In my opinion, it was not feasible to attempt mass testing and juvenile selection among trees less than 1.5 cm in diameter.

Figure 1. — Interior of greenhouse showing two seedbeds that represent two replicates in the experimental design (Gabriel 1969).

We are now successfully mini-tapping trees at or above a minimum stem diameter of 1.5 cm. Uniform testing of large groups of trees is now possible because of a more dependable sap flow, and because trees can now be directly exposed to the weather. Further improvements in technique were made possible by tapping larger seedlings. Using a larger cannula (number 13) has virtually eliminated spile clogging, and adding a length of surgical tubing leading from the spile to a container allows the collection of a larger volume of sap during

Figure 2. — To determine the sugar content, a drop of sap at the end of a cannula is collected on a refractometer plate (Gabriel 1969).

the sap-flow period (Fig. 3). The collected sap is now more representative of the range in sap sweetness that might occur during the run, and provides a broader base for sap sampling.

The technique described here will be useful for selecting crop trees when thinning young maple stands for sugarbush development. Even in very young stands, trees with a high sap-sugar content relative to their neighbors can be selected. These are the trees to retain and favor for future sap production.

In summary, the change to a 1.5-cm minimum stem diameter and modification of the mini-tapping technique have made it possible to resume studies of the correlation between juvenile and mature performances of sugar maples in sap-sugar production.

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Figure 3. — Mini-tapping small sugar maples using a cannula spile, surgical tubing, and a milk container.

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